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As the babies grew stronger they were fed alternately with the dropper, and by the rubber nipple, and then, later, all save Barbara took the bottle regularly. In the night Barbara would take half of her tiny portion from the bottle, and then the rest was fed by the dropper.

By September 1, a second wet nurse was engaged, and the babies, having plenty of food, settled down to gain steadily. The following table shows the rate of increase:

	At Birth—Aug. 5.	Sept. 5.	Nov. 5.	Dec. 5.
Virginia	Nearly 4 lb.	4 lb. 8 oz.	7 lb. 2 oz.	8 lb. 11 oz.
Eleanor	Nearly 3 lb.	4 lb.	6 lb. 2 oz.	6 lb. 11 oz.
Barbara	Over 3 lb.	4 lb. 1 oz.	6 lb. 2 oz.	7 lb. 2 oz.
Louise	4 lb.	4 lb. 8 oz.	7 lb. 1 oz.	8 lb. 7 oz.

Between September fifth and twelfth the babies learned to nurse directly from the breast, and they did this except when fed the milk of their own mother, which was being sent daily to the hospital, and was of good quality and a steadily increasing quantity up to thirteen ounces a day.

On September 14, it was decided to move the babies and their wet nurses to a small hospital nearly opposite the home of the parents, so that the mother might nurse two of the babies in the daytime. The removal was made very quietly and carefully.

It will be seen from the table that the first-born has taken the lead. The babies are still on breast milk, they are thriving and all are looking well, though Eleanor is not gaining in weight as fast as the others. On December 5, they had been four months in the world, but if born at term would have been but two and a half months old. The parents are of American ancestry for many generations. As far back as the family records go there is no mention of twins. They have a small son aged five.

INFANTILE PARALYSIS

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Summarizing these symptoms, then, there is a very common and well-defined picture of a feverish child with some gastro-intestinal disturbance, frequently only loss of appetite, drowsy but irritable, tender to handle, and with stiffness of neck and back.

There is a symptom that I have not yet mentioned that is almost constant and very important in view of the fully developed picture, but which is so little distinctive that I have left it till the last, and that is weakness. You expect weakness in a sick child, and the weakness is often marked and generalized, but a careful examination frequently discloses a localized weakness. The child favors one arm or has a slight limp, but is not definitely paralyzed.

I will not go into the signs and symptoms that develop at the end of this prodromal period, when a definite paralysis sets in, but I would like to remind you of how varied in distribution that paralysis may be. One or all or any combination of limbs may be wholly, partially or only very slightly paralyzed, and careful observation is important, not only for the purposes of diagnosis, but for the later treatment. Further than that, the study of the pathology shows that any part of the body musculature may be involved. As you probably are aware, the progress of the disease may stop short of any demonstrable paralysis and convalescence set in after the very slightest of prodromal symptoms, giving the abortive type of case which is unfortunately very hard to diagnose, but just as important as an infectious agent as the typical case. We know also that accompanying a frank paralysis of a limb or limbs, there is frequently weakness or paralysis of such small muscles as control the movements of the eyeball or of facial expression. It is further evident that there are cases that show no paralytic symptoms except those due to an affection of such small muscles. There are cases where a diagnosis is made on a typical history of onset with a slight facial asymmetry, best seen when the child cries. In one case where no other diagnosis but that of poliomyelitis could be made, the child had a paralysis of one side of the soft palate, so that when she drank water, a little came into her nose. In another there was only a drooping of one eyelid. The hurried visit of a physician may fail to demonstrate some of those finer points, and the evidence of an observant nurse or attendant would be invaluable.

When an acute case of poliomyelitis terminates fatally, it is almost invariably due to some involvement of the muscles of respiration, which may be in itself sufficient to cause death or, as frequently happens, it may permit the onset of a broncho-pneumonia, which, in such cases, is usually rapidly fatal. As regards life, then, prognosis depends to a very great extent on whether or not there is any involvement of respiratory mechanism. In the cases where the involvement is more extensive, the fact that something is wrong with the child's breathing is very apparent. The respirations are rapid, they require effort and are usually peculiarly

jerky. The mechanism of respiration includes the action of the diaphragm, of the intercostal muscles and of the accessory muscles of respiration, more especially the muscles of the neck. All of these should be watched. With the diaphragm alone or with the intercostals alone, a child may get on quite comfortably,—in the first case it is seen that the anterior abdominal wall is rising and falling much more vigorously than usual, and that the thoracic wall, instead of bulging with inspiration and flattening with expiration, is being flattened with each inspiration and perhaps there is some drawing in of the intercostal spaces, especially near the costal margin. If a hand be now placed on the abdomen and increasing pressure gradually applied, the patient manifests immediate distress, showing that the intercostals are incapable of taking on the full duties of respiration. In the second case the diaphragm is paralyzed, and here, instead of the normal gentle rise and fall of the abdominal wall with inspiration and expiration, it is seen that during inspiration the abdominal wall is drawn in and that it bulges again on expiration, while the thoracic movements are considerably exaggerated. If, now, the thorax be gently compressed with the hand, the distress is at once evident, as the intercostals are being hampered and the diaphragm is not taking its share in the work. It may, of course, happen that both sets of musculature are weak or that one side of the chest or one side of the diaphragm is paralyzed, or any combination of these conditions may exist. If there is not sufficient action of diaphragm and intercostals to maintain efficiency, then the accessory muscles of respiration come into play, the muscles of the neck contract and relax with visible or painful effort, the head is thrown back to gain a purchase for the more effective action of those neck muscles on the thorax, and, as a rule, there is obvious sign of insufficient aeration in the blue lips and cyanotic complexion. All these signs must be carefully watched for. It is not sufficient to watch the recorded respirations per minute, since there need be no actual quickening with, for example, a healthy diaphragm and paralyzed intercostals, the one muscle being sufficient for normal requirements. If, as we all hope, a life saving treatment be soon perfected, it will be all important to know that the muscles of respiration are becoming involved at the earliest possible moment, since once started, the paralysis may spread so rapidly as to cause death in a few hours. Further, in a child with even the slightest respiratory involvement, a mild cough, perhaps evidence of slight congestion of the bronchial tubes and of no dangerous significance in a patient with respiratory mechanism unaffected, may be the first indication of a bronchitis or broncho-pneumonia that will develop so rapidly, since the resistance is lowered by the

mechanical disability, as to cause death in a few hours. It frequently happens in fatal cases that death is reported to have been due to heart failure and not asphyxia. In such cases there is usually a history of some respiratory involvement, but sometimes of an irregular incoördination in the movements, rather than of a definite paralysis of diaphragm and intercostals, and also of an irregularity of the pulse. The pulse must, therefore, be watched carefully, not only as to its actual rate, but also as to whether it is regular or irregular. From analogy with the conditions in other parts of the body and their relations to the pathology, it is possible that in such cases there is an involvement of the centres that control the heart's mechanism. When a child is still obviously ill and while there is still fever and other signs of an acute disease, it is impossible to give any prognosis as to life. After the temperature has settled definitely and the child begins to take a more active interest in its surroundings, it is probable that no further spread of the paralysis will take place, but even the abatement of the fever must not be an occasion for giving a definite prognosis, as it is not uncommon to see the condition spread for two or three days after the temperature has settled, and it should always be the rule to give a very guarded prognosis in the acute stages.

In the present state of our knowledge as to treatment in acute poliomyelitis, nursing takes a very prominent place in the measures at our command for the relief of the patient and for the prevention of undesirable after-results. As regards the general points of nursing, it is like any other acute infection. The child must be kept in bed, even if it is fit to be up, and as complete rest as possible must be insisted upon until all signs of the acute stage are absent. Solid food should be withheld during the acute stage and, as a rule, the child is satisfied without it, but there is no indication for withholding solid food when the child begins to show a desire for it, and there is usually very good appetite as soon as convalescence sets in. The child is very thirsty and there can be no reason to withhold fluids. In this connection it is well to note that in cases with respiratory involvement, the thirst is unusually great and the mouth and tongue often unusually dry. The comfort the child gets from the tongue and mouth being kept moist is very apparent, but great care must be taken not to give much at a time or to give it rapidly, as the danger of aspiration pneumonia is great. A piece of gauze soaked in fluid and put into the child's mouth to let it suck it, is a great convenience in these cases where any difficulty in swallowing is apprehended. In some cases a difficulty in swallowing may be due to the fact that the whole attention of the patient is occupied

with its breathing, but in some there is actual paralysis of the tongue or jaw or pharynx, and recourse may need to be taken to feeding by stomach or nasal tubes. When feeding an ordinary, well-marked acute case, it may have to be done with the child flat on its back, as the raising of the child's head to quite a small extent causes very considerable pain and discomfort.

The bowels are usually constipated. Cathartics and injections have to be used frequently. The use of the bedpan and the administration of enemata are causes of much pain to the child, and the very gentlest handling is here essential. The constipation is often due to weakness of muscles such as those of the anterior abdominal wall, and cathartics are in such cases less effectual than usual, so that enemata have to be frequently used. The bladder is another source of trouble. The power of expelling the contents of the bladder may be interfered with, and this can be very easily overlooked. The patients are often restless and irritable, and this condition may be put down to the general condition, while the true reason, namely a full bladder, is overlooked. This must be carefully watched for. A warm bath or a warm application may be sufficient to relieve. Sweet spirits of nitre in 15–30m doses is a useful addition. Though at first troublesome, this difficulty seldom lasts more than from twenty-four to thirty-six hours. The catheter, however, may need to be used.

A restless, irritable patient, too young to tell of its discomforts and wants, with limbs and back paralyzed, with extreme tenderness on slightest movement, with perhaps constant pain, is a case where observant and careful nursing is of the greatest value. There is seldom absence of the sense of touch or pain, and there is not the tendency to sores, as is found in cases of paralysis combined with sensory disturbances, but the child may have to lie for months on its back with no power to move its limbs, so that care must be taken to protect prominences coming in contact with the bed, and to keep the skin clean and dry. Placing the child in such a position that the neck and back may be supported in the straight or in the slightly arched and retracted position will often give relief and stop much of the restlessness. Spontaneous pain is greatly relieved by warm applications. Hot water bags under the legs and by the sides are useful in relieving pain and at the same time in giving a soft surface for the legs and heels to rest upon. Occasionally medicinal agents have to be used,—bromides or antipyrin for the younger, phenacetin and aspirin for the older patients are then useful, and even morphia may have to be given, though very rarely and in the older cases only. Two years is, by far, the commonest age of attack. Most of the

cases are between one and six, but even younger cases occur, and older ones up to twenty and twenty-one are by no means rare. The pain, however, is rarely spontaneous,—rather the spontaneous pain is less evident than that produced by passive movements or by pressure. The child dreads to be moved. The approach of a person whom he thinks will handle or move him causes fright and makes him cry. To differentiate between true pain and the fear of pain is difficult, but in the acute stage and often for long after the fever and other acute symptoms have subsided, there is true and definite tenderness. Pressure of the clothes must be avoided, and a cradle must be used, or the bedclothes stretched across from side to side of the crib. Too much cold is to be avoided, as it seems to increase the pain, and the extremities of these children are often difficult to keep warm. But, on the other hand, when too warm, the patient becomes restless and the movement causes even more pain. The pressure of clothes can cause pain in another way besides that of actual contact and pressure on tender limbs; they may press on the limbs so as to alter their position. Movements and stretching of the paralyzed muscles, above all things, cause pain, and heavy clothes may press on the foot and stretching the paralyzed muscles on the anterior aspect of the leg cause much discomfort. The position of a limb that is most restful is the one that fulfils these conditions. An arm slightly abducted from the side with elbow slightly flexed and semi-pronated, is comfortable and is a position easily attained by letting the hand and forearm rest on the abdomen. With the leg it is more difficult, as in some cases, with the meningitic symptoms of stiffness of the back well marked, any flexion of the hip is disturbing, but frequently a small pillow under the knees will help. Much more important, however, than simple position is the stability of the limb. Fixation by splints is not irksome if judiciously applied,—in fact, some children cry when they are removed and want them reapplied. This is well seen in cases where the extensors of the ankle are affected and a foot unsupported will drop and the toes point and the damaged muscles will be put on the stretch. Here some light wire or malleable iron splint, well padded and applied to the back of the leg with a part at right angles to support the sole of the foot, is very gratefully received. In the arm also, where the most commonly affected muscle is the deltoid, paralysis of which causes the arm to lie helpless at the side and allows the weight of the arm to drag on the shoulder, a light splint bent to an angle of about half a right angle and placed in the axilla, supports the arm and relaxes the paralyzed and tender muscle.

Apart from the relieving of the acute tenderness, there is another

and very important reason for this supporting of paralyzed limbs and relaxing of paralyzed muscles. It is a fundamental principle in orthopedics that a stretched muscle does not recover, as does a relaxed one. Further, if a muscle atrophies, it loses its elasticity. From the very first, then, we must consider carefully the position we allow any part of a limb to rest in. Do not put any muscle on the stretch, for it will not recover so well, or, if bound to atrophy because of the intensity of the changes in the nerve cells controlling that muscle, it will be permanently stretched and give no support to the limb. Further, if one muscle be overstretched, its opposing group will be fixed in a position of shortening and will be another factor in the production of deformities. It is fortunate that the position of a limb that best relieves tenderness is also the position best calculated to assist recovery and to prevent deformities. During the acutely tender stage, when complete rest is so advisable, it is well to splint the part night and day. In the course of a few days to a week or two, this acutely tender stage passes off, the limbs can be handled gently, but any rough handling or heavy pressure still causes pain. The nutrition of the muscles must be maintained. The muscles cannot, by their own contractions, maintain an adequate circulation, and massage is then all important. The question is when to commence massage. As soon as the child will stand it. At first only very gentle manipulation can be carried out, but carry out what you can and very soon you will be able to give fifteen minutes night and morning without difficulty. Passive movements must also be commenced as soon as possible, but you will usually find a few minutes gentle massage can be carried out before passive movements can be commenced. Some people advocate waiting till all tenderness has passed before commencing, in case you re-excite the inflammatory process, but if it is done judiciously and short of producing pain, we have seen no reason to delay, and often it is noticed that cases that first seek advice three weeks or so after onset, already show atrophy, which is very rare at that period in treated cases. Active movements are perhaps the most important of all and should be encouraged as early as possible, when the tenderness persists. A child will seldom move a limb when it is painful to do so. Once you have induced a confidence in you on the part of the child, that is, when the child has learned that your treatment is not a painful procedure, it will aid you whole-heartedly in your efforts to encourage movements, and from that date the muscle will steadily gain in strength. You must, therefore, know what muscles are paralyzed, and you must know in what movements the function of those muscles is concerned. Some muscles, as I said before, cannot recover, and no amount of encourage-

ment will make the child carry out certain movements. Your object is now two-fold: to get active movements and still to prevent deformities. The muscles on the anterior aspect of the leg may be rapidly recovering, the calf muscles may be still completely flaccid; it will not do to let the anterior muscles pull on the foot, so as to stretch the calf muscles and hinder their recovery or destroy their elasticity. The right-angled splint is still necessary, but it is sufficient in most cases to splint during the night only and leave the limb free during the day, but every case must be decided on the condition present at the time and in the individual.

There is a very useful detail in treatment to induce active movements early and that is the use of the warm bath, which relaxes your patient and supports the limbs which are thus enabled to move with much greater freedom than when the child is lying in bed. Put a few floating toys in the bath and the child plays with them, using the limbs naturally, and looks forward with much enjoyment to its daily treatment. At this stage, then, when the acute condition is passing off, massage for say fifteen minutes night and morning, encouragement in active, natural movements and prevention of deformities are the lines of treatment.

I have said nothing of electricity because I do not consider it nearly so important as massage and because it is not so simple a procedure, but there can be no doubt that electrical treatment is an aid in maintaining the nutrition of muscles and nerves, but it belongs more to the treatment of the later stages, as does also the application of braces and other ambulant appliances.

Improvement may be expected to continue for months and even years, and treatment should not be discontinued, but should be under the direction of an orthopedic surgeon who can prevent so many of the deformities that, once established, require operative measures to correct.

It was recently reported that after the acute stage had passed, the application of Bier's congestion by means of vacuum cups to the skin over the spinal column caused a hyperæmia of the spinal cord and a better recovery in the paralyzed muscles. The results in a fairly extensive series of cases are far from convincing, but there is no contra-indication for this line of treatment, though it must not be employed till the acute stage of congestion has passed and can have no effect in checking advance.

There is no specific medicinal or other treatment that will influence the advance of this disease, once the patient is attacked. No serum treatment has as yet been perfected. For any such treatment to be of value,

an early preparalytic diagnosis is necessary, and you can understand from the nature of the early symptoms that this is by no means easy. Examination of the spinal fluid is a help, but we know too little about the condition of the fluid in other acute infections to regard its evidence as absolute. In almost all cases the diagnosis, then, is made only with onset of paralysis, and in the majority of them no further advance follows. In the fatal cases, however, an advancing condition is present and it may be possible to check this advance as further researches in treatment are carried on. At present urotropin, which has an antiseptic action on the spinal fluid when administered by mouth, is the only agent at our command. Its action, however, is not convincing, but in all cases should be given a trial. This summer it has been shown that injections into the spinal canal of adrenalin checks the advance of the disease in monkeys, and this has been tried in several cases in children without any definite success. Several other medicinal substances have been suggested and tried, but they have all proved even more hopeless.

It would appear, then, that the best hope of checking the mortality due to poliomyelitis and of preventing the crippling of so large a number of healthy, strong children is to turn our attention, for the present, to preventive measures. To carry out such measures successfully, we must know how the disease is conveyed from child to child and what is the point of entrance. The virus has been shown, as in the case of measles, to belong to what is known as the group of filterable viruses; that is, to say, the infective material passes through the finest filters. Under the highest power of the microscope, it cannot be seen. By employing the dark field microscope, it cannot be seen, yet all evidence, and a very great deal has been collected, points to the fact that we are dealing with a living organism. And so we come to the conclusion that the organism is smaller than the wave length of light. A study of the epidemics has frequently suggested that the disease is insect borne, and recent researches have shown that the biting stable-fly may be a source of infection. The point is not yet conclusive. Experimentation on a much more extensive scale, both in New York and Sweden, point to the nose and throat as the point of entrance, and the possibility of healthy people carrying the infection from child to child in the secretions from the mucous membrane of nose and throat. I cannot now go into the details of the evidence of these experiments and of the points in which the different observers just fail to establish solutions to the problem, but from that work we have sufficient evidence on which to base prophylactic measures. The possibility of the virus being present in the secretions from the bowel, as well as in the naso-pharynx, has also been demon-

strated. In all cases, then, we must regard every child with poliomyelitis, whether paralyzed or of the abortive type, when the disease does not advance to the extent of paralysis, as a source of infection and of danger to others. These abortive cases are perhaps the most dangerous, as less likely to be diagnosed and so not isolated, and we have every reason to believe that they are far more common than statistics show. In fact, during an epidemic all suspicious cases also should be regarded as sources of infection,—sources of infection not only by direct contact with other children, but through the intermediary adult who comes in contact with them and through any article in their surroundings,—even the dust in their room. Very stringent measures of isolation should then be urged and it is only because these points are not yet definitely proved in their entirety that stringent measures are not enforced. That is, however, no reason why they should not be adopted where possible.

The patient should then be strictly isolated in a room that may be conveniently disinfected afterwards. All persons coming in contact with the child should wear a coat or clothes that are changed on leaving the room and can be easily cleansed. All dishes, bedpans and other utensils should be boiled or otherwise disinfected. All excreta should be sterilized by heat or with some disinfectant such as bichloride of mercury. The dust of the room should be similarly treated and these precautions should be taken also with clothes that the patient wore during the prodromal period and other articles, such as bed clothes, that may have been infected before the diagnosis could be made. As preventive treatment for those directly exposed, it is well to administer urotropin for about one week, and all persons attending on the child should cleanse their throats with a spray or gargle of one per cent. peroxide of hydrogen or one-half per cent. solution of menthol, before mixing with other people. It is not advisable to administer such washes to the patients themselves, however, as their continued application irritates and defeats its purpose, as it excites increased secretion of the infective mucus. Such precautions can be easily carried out in a hospital and are not impossible in a private house, and when our knowledge on these subjects is proved incontestably and a strict isolation required, we may hope for some success in checking the epidemics.

I spoke of the possibility of the disease being conveyed by biting flies, and especially by the horse-fly. It is an elementary principle of hygiene to keep a house as clear as possible of flies, but this may be repeated with emphasis in the case of a patient suffering from this disease, as the fly may become infected from such and spread the disease in the neighborhood. During an epidemic regard all flies with suspicion.

The question as to how long a patient is infectious is, as in all infectious diseases, not capable of absolute definition. Three or four weeks after onset of symptoms is generally advocated and may, in most cases, be sufficient, but the longer the better, since the virus has been demonstrated at the end of a much longer period.

This disease is a terrible one in its crippling results and dramatic fatalities, and if I can give you no present help as to therapeutic methods of checking its advance in a case once established, I shall be satisfied if I have indicated that there are possibilities of prevention and that judicious treatment in the acute stages can prevent deformities and encourage recovery in paralyzed muscles.

SOME NURSES' VAGARIES

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I WISH to begin by saying that I have only the highest regard for nurses as a class. I believe them to be thoughtful and conscientious in their work, as a rule, and considerate of their patients. Often the work itself is trying and very hard, and sometimes consideration is not shown nurses in the households where duty takes them, but every once in a while I run across some little mannerism that makes for trouble, or more often a lack of tact that causes annoyance, and sometimes there appears to be evidence of lack of knowledge. It is my purpose, therefore, to call attention to a few of these things that have come within my own experience.

Every good nurse will not fit the circumstances of every case. Some nurses are more clever in some kinds of work than they are in other kinds. Again, nurses are human and are more congenial to some patients than they are to others. And it sometimes happens, as a consequence, that a nurse will have to be changed in the middle of a case, not because she is not a good nurse, but because she and the patient don't quite agree.

A nurse, and this applies to the doctor as well, should not be afraid of the disease that the patient has. Fear tends to destroy her efficiency. I recently had a nurse on a case of heart disease with secondary bronchitis. After a few days I had to make a change because the nurse could not rid herself of the idea that the patient had tuberculosis, of